

List of questions related to the modeling of wind power for the EPA/DOE 2nd RE Modeling Summit

There are 5 main questions with a hierarchy of more probing sub-questions under each. The intent is not that each modeler have a formal answer to each of the sub-questions, but rather that they might use the sub-questions to ensure their response covers the full set of issues related to the main question

- 1) How does the model determine the market penetration of wind?
 - i) Is it based solely on cost? i.e. does it explicitly consider other factors such as social preferences, system reliability, macro-economic costs and benefits, other externalities?
 - ii) Does it explicitly consider state-level programs such as RPS?
 - iii) Could it model a national RPS? how?
 - iv) Does it consider retirement of wind farms/turbines?
 - v) Can it explicitly consider "green marketing" or "green pricing"?
 - vi) Is the demand for electricity responsive to electricity price in your model?
 - vii) Will end-use efficiency options reduce electricity demand (and therefore the need for new wind capacity) if electricity prices are high?
- 2) How does the model determine the amount of wind resource available?
 - i) Source of resource data
 - ii) Regional disaggregation
 - iii) Time disaggregation, i.e. does the amount of wind vary seasonally? diurnally?
 - (1) Source of the time disaggregated resource dataAre offshore wind resources included?
- 3) How does the model determine the cost of wind power generation?
 - i) capital costs
 - (1) Linear with size, e.g.. expressed as \$/kW
 - (a) vary with wind resource class/quality, i.e. different cost per kW for class 4 versus class 6 resource site?
 - (2) improvements over time
 - (a) time varying inputs
 - (b) learning curve
 - (3) Disaggregation by component, e.g., land costs, permitting, site development, transmission interconnection
 - (a) Do land/permitting/siting/interconnection costs increase with market penetration as the best sites are assumed to be used first?
 - (4) Are offshore wind costs modeled differently?
 - ii) O&M
 - (1) Vary with resource class/quality, i.e. different for class 4 than class 6?
 - (2) Distinction between fixed and variable O&M costs
 - (3) Improvements over time, i.e. year-to-year
 - (4) Insurance costs
 - (5) land rental costs
 - iii) Generation
 - (1) Does the capacity factor improve from one year to the next?
 - (2) Does the capacity factor vary seasonally? diurnally?
 - (3) Does the model explicitly take into account in-field losses?
 - (4) Does the model explicitly include turbine/farm availability (i.e. forced outages)
 - iv) taxes
 - (1) federal income taxes
 - (a) depreciation

- (b) PTC
 - (i) rate (after tax value)
 - (ii) term
 - (iii) sunset date
 - (2) state income taxes
 - (3) property taxes
 - v) financing
 - (1) distinction between regulated rate of return, IPPs, munis
 - monetization of the PTC included in the debt-service-coverage ratio?
- 4) How does your model treat transmission of wind?
- i) How does it consider availability of existing transmission lines?
 - (1) Does it consider the capacity of existing lines?
 - (i) Does it consider congestion bottlenecks explicitly?
 - ii) What costs does it assign to transmission of wind energy?
 - (1) Does it distinguish between existing and new (yet-to-be-built) transmission lines?
 - (2) Is the cost a function of distance from the wind site to
 - (a) the nearest existing transmission line?
 - (i) must the existing transmission line have capacity available?
 - (ii) Does the transmission capacity available vary with the time segment?
 - (b) a near-by load center?
 - (i) Must it compete with other power sources at that load center?
 - (3) Can it consider rate pancaking across different power pools or RTOs?
 - (4) How does it cost out the construction of new transmission lines?
 - (a) What load factor is used for the new line?
 - (b) Must the line be dedicated to wind?
 - (i) If multiple technologies use the line, how are the costs allocated?
 - iii) Does the model explicitly consider transmission losses?
 - (1) As a function of distance?
- 5) How does your model treat the intermittency of wind?
- i) What capacity credit does it provide to wind?
 - (1) Is it a function of:
 - (a) wind class/resource quality
 - (b) fraction of the load met by wind
 - (c) dispersion of the wind resources
 - (d) coincidence of wind and peak loads
 - (2) Does it vary over time (i.e. year-to-year)
 - ii) Does the model include ancillary services costs
 - (1) Which ones: regulation reserves, spinning reserves, non-spinning reserves, load-following reserves, VAR support, other?
 - (a) How are they calculated?
 - (i) Stochastically?
 - (ii) Is wind forecasting accuracy explicitly considered?
 - (iii) At what regional level are they calculated? E.g. NERC subregions?
 - iii) Does the model account for surplus energy (e.g. when the wind blowing on a weekend night exceeds the demand minus "must run" unit generation)
 - iv) Does intermittency impact transmission costs?
 - v) Does the model include any form of wind-hybrid technology?
 - vi) Does the model include any form of dedicated storage?

Extra Credit Question: Is there anything else in your model that has a significant direct impact on the market penetration of wind?